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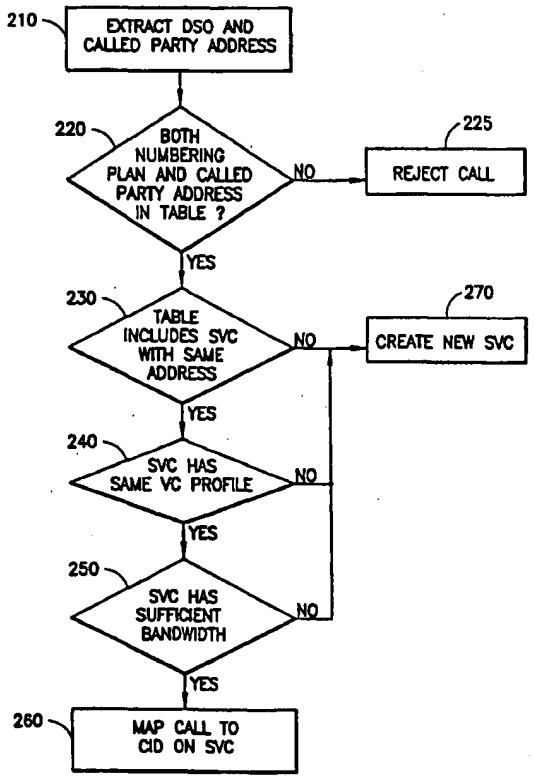
(54) Title: METHOD AND APPARATUS FOR MAPPING NARROWBAND DS0 CIRCUITS INTO AAL2 TYPE SWITCHED VIRTUAL CIRCUITS

(57) Abstract

The narrowband DS0 circuit ID and the called party address of a narrowband call SETUP request received by an ATM switch are used by the switch to identify a virtual channel profile (VCPRO) and a broadband address (BBA) (210). The VCPRO and BBA are then compared to teh VCPROs and BBAs of all existing calls which are carried by SVCs and serviced by the switch in order to determine whether or not a suitable existing SVC is presently set up which can carry the call to the termination endpoint of the call (220). If such an SVC exists (230), a connection admission control (CAC) is run on the SVC of that call in order to determine whether sufficient bandwidth to carry the requested call is available on that SVC (240). If sufficient bandwidth is available (250), the call is accepted, placed into the SVC, and the details of the call, are entered into the active call structure table (260). If sufficient bandwidth is not available, or if no suitable existing SVC is available, a new SVC is set up between the switch and the destination switch, or the call is rejected (225).



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METHOD AND APPARATUS FOR MAPPING NARROWBAND DS0 CIRCUITS INTO AAL2 TYPE SWITCHED VIRTUAL CIRCUITS

The present invention is related to co-owned U.S. Serial No. 09/015,503, filed Jan. 29, 1998 and entitled "Voice Server Module for ATM Switch", and co-owned U.S. Serial No. (DOCKET GDC-131) filed concurrently herewith and entitled "Method and Apparatus for Generation of ATM AAL2 Type Broadband SETUP Message from Narrowband SETUP Request", both of which are hereby incorporated by reference in their entirety herein.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to telecommunications. More particularly, the present invention relates to the interworking of narrowband signaling with broadband signaling, and specifically to the mapping of narrowband DS0 circuits into AAL2-type virtual connections.

2. State of the Art

For approximately a century, the narrowband telecommunication network was the dominant mechanism for all telecommunications in the U.S and worldwide. The narrowband telecommunications network was designed and primarily directed to the transport of voice information, with analog lines between homes and offices and central offices, and trunks between central offices. Over the years, different protocols have been added to the narrowband telecommunications network to handle various aspects of the network. For example, during the last fifteen years or so, an SS7 overlay network has been provided for signaling. In addition, as data and video transport has become an important use of the telecommunications network, narrowband ISDN was touted as a desirable protocol for handling video, voice and data.

Because the demand for the transport of data and video has virtually exploded over the last ten years, a new network based

on asynchronous transport mechanism (ATM) telecommunications technology has been defined and built. Thus, there now exist two primary backbones to the telecommunications network in the U.S. and worldwide. The ATM network (also referred to herein as the "broadband" network) was originally conceived and provided primarily for data transport (as opposed to voice). However, because of the flexibility and advantages of ATM, demand has grown for the carrying of voice over the ATM network. In response to that demand, various organizations such as the ITU-T and the ATM Forum have defined ATM Adaptation Level 2 (AAL2) standards and recommendations which are intended to integrate the carrying of voice data into the ATM scheme. While the AAL2 protocol has been established, presently, there is very little commercial activity utilizing AAL2. This lack of activity is probably the result of the present requirements for the use of AAL2. In particular, presently, in order to utilize AAL2, the customer must provide the network with AAL2 type information in generating a call. Alternatively, a non-ATM type call may be carried in certain very limited circumstances by the ATM network by establishing a PVC (permanent virtual channel) for the user which carries all non-ATM voice data (i.e., there is a static map from the incoming narrowband call to an outgoing broadband call). However, these uses of AAL2 require either the purchase of specialized equipment by the user, or the maintenance of an expensive PVC link. True interworking for voice data between the narrowband network and the ATM network has not yet been established in the art.

SUMMARY OF THE INVENTION

It is therefore an object of the invention to provide an interworking mechanism for narrowband and broadband voice signals.

It is another object of the invention to provide an apparatus and method for mapping narrowband DS0 circuits into existing broadband AAL2 switched virtual connections (SVCs).

In accord with the objects of the invention which are described in more detail hereinafter, upon receiving a narrowband signaling setup request, the narrowband DS0 circuit ID, and the called party address are used to determine whether or not an existing SVC is presently set up which can carry the call to the termination endpoint of the call. If such an SVC exists, and if the characteristics of that SVC match the characteristics of the newly requested connection, and if sufficient bandwidth is available on that SVC, the new call is mapped onto that SVC. If no SVC is presently set up to carry the call to the termination endpoint, or if the characteristics of that SVC do not match the characteristics of the requested connection, or if sufficient bandwidth is not available on that SVC, a new SVC will be set up or the call will be rejected.

According to a preferred aspect of the invention, the narrowband channel ID is used to access a DS0 to numbering plan database. The resulting numbering plan and the called party number obtained from the narrowband signaling setup request are then utilized to access a first table which relates the numbering plan and the called party number prefix to a VC profile number (VCPRO) and a broadband address. If the numbering plan and called party number prefix do not appear in the first table, the call is rejected. However, if the numbering plan and called party number prefix do appear, they provide a broadband address (BBA) and a VC profile number. The obtained BBA and VC profile number are then compared to the BBAs and VC profile numbers of all active calls which are tracked in an active call structure table. If an active call found in the active call structure table has the same BBA and VCPRO, a connection admission control (CAC) is run on the SVC of that call in order to determine whether sufficient bandwidth to carry the requested call is available on that SVC. If sufficient bandwidth is available, the call is accepted, placed into the SVC (according to the ITU-T Q.aal2 standard), and the details of the call, including the BBA, VCPRO, SVCID (SVC identification), called party number, CID (channel ID), and DS0, are entered into the active call structure table. If sufficient bandwidth is not

available, a new SVC is preferably set up between the switch and the destination switch.

Additional objects and advantages of the invention will become apparent to those skilled in the art upon reference to the detailed description taken in conjunction with the provided figures.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a high level diagram of an ATM switch incorporating the mechanism of the invention for mapping narrowband DS0 circuits into AAL2 type switched virtual circuits.

Fig. 2 is a block diagram of a voice server module of the ATM switch of Fig. 1;

Fig. 3 is block diagram representing data structures utilized in the interworking method of the invention.

Fig. 4 is a high level flow diagram of the method of the invention.

Fig. 5a is a prior art chart detailing the SETUP message for a narrowband Q.931 ISDN signal.

Fig. 5b is a prior art chart detailing the SETUP message for a narrowband SS7 ISUP signal.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The method and apparatus of the invention for the mapping of narrowband DS0 circuits into AAL2 type switched virtual circuits is preferably implemented in an ATM switch such as the GDC APEX (a registered trademark of General DataComm, Inc.) seen in Fig. 1, although it will be appreciated that many other switches could be utilized to embody the invention. The GDC APEX switch 10 includes a mid-plane 14 having a switch fabric card 15, a plurality of line interface modules (LIMs) 16a,

16b..., and a plurality of controller cards (also called "slot controllers") 18a, 18b, ... The function of each of the LIMs 16 is to take incoming electrical or optical signal information from various lines, such as data channels, private networks, public networks, etc., to extract data and timing information therefrom, and to send a TTL digital signal representative of the data to an associated controller card 18. The controller cards include adaptation controllers and cell controllers. The function of the adaptation controller is to convert the TTL digital signals received from LIMs receiving legacy signals (e.g., T1, E1) into an ATM signal (i.e., ATM adaptation). The ATM signal is then forwarded to the switch fabric for switching as desired. After switching, the ATM signal is provided to a cell controller which forwards the ATM signal to a LIM which is coupled to the ATM network (not shown).

According to the present invention at least one of the slot controllers 18 of the ATM switch 10 is a voice server module (VSM) which is configured to accept voice data, as well as other data from a LIM. In a preferred embodiment, each VSM slot controller 18VSM is capable of processing data received from a LIM which is coupled to four E1 or T1 lines at 2.048 Mbits/sec or 1.544 Mbits/sec respectively. Where the LIM is coupled to T1 lines, the LIM performs a timing conversion such that the data presented to the VSM slot controller 18VSM is at the E1 2.048 Mb/s rate.

Turning to Fig. 2, a block diagram of a voice server module 18VSM is seen. The voice server module 18VSM includes a multiplexer/interface 20, a voice processing DSP array 30 for processing voice data, an adaptation layer processor 40, a management processor 50, a channel associated signaling (CAS) processor 60, and a LIM-management interface 70. Details of the functioning of each of the elements of the voice server module are provided in previously incorporated U.S. Serial No. 09/015,503. For purposes of the present invention, it is noted that the narrowband call SETUP request (carried on a D-channel) is received by the highway combiner/D-channel extractor, and

forwarded to the management processor 50. The interworking of the invention is preferably carried out by the management processor 50 as described below with reference to Figs. 3 and 4. As a result of the interworking, if the call can be accepted and placed into an existing SVC, the management processor 50 causes voice data for that call received in the B-channel DS0s to be appropriately routed by the highway combiner 20, processed by the DSP array 30, and adapted 40, before being switched in the switch fabric 14 and sent out as part of an ATM AAL2 type signal.

According to a preferred embodiment of the invention, the management processor has memory 100 associated therewith. As seen in Fig. 3, the memory 100 is configured to include a "DS0 to numbering plan" database 110, a "numbering plan - called party number - VC profile - broadband address" table or matrix 120, and an active call structure table or matrix 130, although one or more of these memory elements could be located in a different memory if desired. When the signaling DS0 to which the ATM switch is coupled has a narrowband voice call SETUP message therein, the signaling information (carried on the D-channel) is provided by the highway combiner/D-channel extractor 20 to the management processor 50. As seen in prior art Fig. 5a, and known in the art, if the incoming signal is a Q.931 signal, it includes at least a protocol discriminator, a call reference, a message type, bearer capability, a channel identification (indicating in which DS0 the call is being carried), and the called party number. In addition, the Q.931 signal typically also includes information regarding one or more of: network specific facilities, low-layer compatibility, high-layer compatibility, a transit network selector, the calling party number, etc.. Similarly, as seen in prior art Fig. 5b, the SS7 ISUP type SIF signal includes a circuit identification code (CIC) which is equivalent to the channel ID of the Q.931 signal, and certain signaling information such as: the called party number, the calling party's category, and user service information. Optional information may also be carried by the ISUP message.

In the preferred embodiment of the invention, upon receiving the narrowband call SETUP request, the management processor finds the channel ID contained in the narrowband SETUP message and uses the channel ID to access the DS0 to numbering plan database 110. The numbering plan obtained from the database 110, and the called party number are then used to find a VC profile and broadband address (BBA) from table 120. The VC profile (which relates to parameters such as quality-of-service, peak cell rate, sustained cell rate, maximum burst rate, etc., as disclosed in previously incorporated U.S. Serial No. Docket #GDC-131) and the broadband address obtained from table 120 are then compared to the VC profile and BBA of all active calls kept in the active call structure table 130. If the VC profile and BBA of table 120 match the VCPRO and BBA of an active call, CAC procedures are invoked to see if the existing SVC can handle the call. If the SVC can handle the call, procedures set forth in the ITU-T Q.aal2 standard are utilized to insert the call into an existing SVC. However, if no match is found, a new SVC is preferably created with the VC profile parameters identified.

More particularly, and with reference to Figs. 3 and 4, when the narrowband call SETUP request is received, information contained therein is extracted (at 210 of Fig. 4) by the management processor. This information preferably includes the channel ID and called party number. The channel ID sets forth in which DS0 the call is to be carried. Because each DS0 can utilize a different numbering plan (e.g., the same "001" international prefix can be used to call different locations depending upon who is calling), both the numbering plan (or channel ID) and the called party number serve as inputs to the table 120 in order to find a VC profile. The value of utilizing a DS0 to numbering plan database 110, is that the database need not be located in the same memory as the table 120. Thus, for example, if the Q.931 and ISUP interworkings are carried out in different management processors (each using its own table 120), the separate DS0 to numbering plan database 110 could be utilized in both situations.

The numbering plan and called party number to VC profile table 120 is shown in Fig. 3 to include six fields, including the numbering plan (NP), a routing flag (FG), the VC profile number (VCPRO), the compression type (CMP), the called party number (CLPNUM), and the broadband address. The numbering plan relates to the ability of different DS0s to use the same number to call different parties as discussed before. The routing flag is used for expediting rerouting when an initial route is not available. The VC profile number relates to the required parameters of the virtual channel onto which the call is to be routed (as discussed below). The compression type relates to the mechanism used to compress the voice data (such as ADPCM, PCM, etc., as described in more detail in the previously incorporated U.S. Serial No. 09/015,503). The called party number is shown as including prefix information, including area codes and central office codes. It will be appreciated that the CLPNUM can include international codes and additional information if desired. The BBA relates to the broadband address of the destination (e.g., an ATM node port which may have a proprietary address or an E.164 address.

As indicated in Fig. 4, if, at 220 the numbering plan and/or called party number are not found in the table 120, a VC profile cannot be found, and the call SETUP request will be rejected (at 225). Thus, for example, if a particular area code is not part of the network, or is not accessible for a particular reason, a called party number will not appear in the table, and a call SETUP request for a call to that area code cannot be accepted.

If the called party number and VC profile number can be found in the table 120, the narrowband call SETUP request can be accepted (pending a CAC determination). According to the invention, the broadband address and VC profile number corresponding to the called party number and numbering plan in table 120 are used to search the active call table 130. If, as determined at 230 and 240 of Fig. 4, the active call table 130

includes a call having the same broadband address, and the VC profile of the SVC carrying that call matches the VC profile of the requested call, then, if there is sufficient bandwidth to carry the requested call (as determined at 250), the requested call is provided with a channel ID (CID) and mapped into the existing SVC at 260 using the ITU-T Q.aal2 Recommendation (see, Draft new ITU-T Recommendation Q.aal2 AAL type 2 Signalling Protocol (Capability Set 1), Temporary Document BER-045R2, Jan. 1999 which is hereby incorporated by reference herein in its entirety). If there is no match of broadband address and VCPRO, then, at 270 a new SVC with desired parameters is preferably set up by the switch to carry the call (if the switch CAC permits); i.e., PNNI signaling procedures are invoked to create a new SVC from the switch to a destination switch, and the call is mapped to a CID in the AAL2 type VC. Similarly, if an SVC having a matching BBA and VCPRO does not have sufficient bandwidth to carry the call, a new SVC is preferably set up at 270 by the switch to carry the call (if the switch CAC permits). In any event, when the call is established, a new entry is automatically generated in the active call structure table 130.

A determination of available bandwidth in an existing SVC is preferably conducted by counting the number of calls in the active call table 130 having the same BBA and VCPRO as the requested call. If the count of existing calls is equal to the number of CIDs provided in the SVC, then resources are not available, and a new SVC must be set up (if possible) to handle the call. If the count is less than the number of CIDs provided in the SVC, then bandwidth is available. It should be appreciated, however, that in certain embodiments of the invention, it may be desirable to permit a call to utilize more than one DS0 (and more than one CID). In fact, in those situations, the incoming call may require more or request more than one DS0. In those cases, the active call table 130 should store information regarding the bandwidth utilized by each call, and a calculation must be run to determine whether bandwidth is available for the incoming call based on the bandwidth utilized by each call already in the SVC.

According to another embodiment of the invention, virtual channel profiles may be ordered according to certain criteria (including quality-of-service (Qos), peak cell rate (PCR), sustained cell rate (SCR), and maximum burst rate (MBS)), such that a VCPRO of "5" is a higher quality channel than a VCPRO of "4", and a VCPRO of "4" is higher quality than a VCPRO of "3", etc. Preferably, where the VCPRO is indicative of relative quality, each parameter of the higher quality channel is better than or equal to a corresponding parameter of a lower quality channel. Then, if the VCPRO number of the existing SVC either matches or exceeds the profile requirements of the incoming call, the incoming call can be handled on the existing SVC. As discussed in previously incorporated Serial Number (Docket GDC-131), the VC profiles are preferably stored in a database (not shown) associated with the management processor.

There have been described and illustrated herein methods and apparatus for mapping narrowband DS0 circuits into wideband AAL2 type switched virtual circuits. While particular embodiments of the invention have been described, it is not intended that the invention be limited thereto, as it is intended that the invention be as broad in scope as the art will allow and that the specification be read likewise. Thus, while the invention has been described with reference to a particular voice server module of a particular ATM switch, it will be appreciated that the invention applies to different types of apparatus and can be implemented in many different ways. For example, the ATM switch can be a switch of the bus-type rather than a switch of the fabric-type. Moreover, the incoming narrowband call SETUP request can be handled in many different ways (e.g., directly by a processor) and need not be subjected to a highway combiner/
D-channel extractor, as can the call when mapped onto an SVC. Further, while the apparatus and method of the invention as described keyed off of the channel ID and the called party number of the incoming narrowband SETUP signal in order to establish interworking, it will be appreciated that other

identifiers, such as calling party number, bearer capability, transit network selector, or other information elements, in certain circumstances can be utilized in addition to, or in lieu of called party number and channel ID in establishing the interworking. Also, while the tables and databases of the invention were described as being located in a memory associated with the management processor of the ATM switch, it will be appreciated that: a) different types of memory can be utilized, b) different arrangements within memory can be utilized to store the desired information (arrays, lists, matrices, etc.), c) the different tables and databases can be located in different locations, and d) one or more of the tables and databases may be combined. It will therefore be appreciated by those skilled in the art that yet other modifications could be made to the provided invention without deviating from its spirit and scope as so claimed.

I claim:

1. In an ATM switch having AAL2 capability, an improvement comprising:

a) means for receiving a narrowband voice call SETUP message;

b) means for identifying, from said narrowband voice call SETUP message, destination information related to said call SETUP message;

c) active call structure means for keeping destination information relating to active broadband calls handled by said ATM switch on SVCs;

d) means for comparing said destination information related to said call SETUP message to said destination information relating to said active broadband calls; and

e) means for mapping a call requested by said call SETUP message into an existing SVC when said destination information related to said call SETUP message substantially matches said destination information relating to a said active broadband call.

2. In an ATM switch according to claim 1, wherein:

said active call structure means also keeps VC profile information regarding virtual channels on which said active broadband calls are mapped,

said means for comparing also compares a VC profile related to said call SETUP message to VC profiles of said active broadband calls,

wherein said means for mapping only maps said call requested by said call SETUP message into an existing SVC when said VC profile related to said call SETUP message sufficiently matches a VC profile of said active broadband call.

3. In an ATM switch according to claim 2, wherein:

said means for mapping includes means for determining whether said existing SVC has bandwidth available for said call requested by call SETUP message.

4. In an ATM switch according to claim 3, wherein:
said means for identifying destination information comprises a channel identification to numbering plan lookup, and a table means for relating a numbering plan and a called party number to a VC profile and a broadband address.

5. In an ATM switch according to claim 4, wherein:
said active call structure means includes a plurality of fields including a broadband address field, a VC profile field, and a called party number field.

6. In an ATM switch according to claim 2, wherein:
said means for identifying destination information comprises a channel identification to numbering plan lookup, and a table means for relating a numbering plan and a called party number to a VC profile and a broadband address.

7. In an ATM switch according to claim 6, wherein:
said active call structure means includes a plurality of fields including a broadband address field, a VC profile field, and a called party number field.

8. In an ATM switch according to claim 7, wherein:
said plurality of fields includes a channel ID field and a DS0 number field.

9. In an ATM switch according to claim 2, wherein:
said VC profile related to said call SETUP message sufficiently matches a VC profile of said active broadband call when a plurality of parameters of said VC profile of said active broadband call have values at least equal to a plurality of parameters of said VC profile related to said call SETUP message.

10. In an ATM switch according to claim 9, wherein:

said plurality of parameters include a quality-of-service parameter, and at least one of a peak cell rate parameter, a sustained cell rate parameter, and a maximum burst size parameter.

11. In an ATM switch according to claim 1, further comprising:

means for receiving narrowband voice call data, and converting said narrowband voice call into an AAL2 type broadband call carried in said existing SVC according to said means for mapping.

12. In an ATM switch according to claim 1, wherein:

said narrowband voice call SETUP message comprises one of an SS7 ISUP call SETUP message, and an ISDN Q.931 call SETUP message.

13. In an ATM switch according to claim 1, further comprising:

means for generating a new SVC when said destination information related to said call SETUP message does not substantially match said destination information relating to said active broadband calls, wherein said means for mapping maps said call requested by said call SETUP message to said new SVC.

14. In an ATM switch according to claim 2, further comprising:

means for generating a new SVC when said destination information and said VC profile related to said call SETUP message do not substantially match both said destination information and said VC profile relating to a said active broadband call, wherein said means for mapping maps said call requested by said call SETUP message to said new SVC.

15. A method of mapping, in an ATM switch, a narrowband signal into an existing broadband signal, comprising:

a) receiving a narrowband voice call SETUP message;

b) identifying, from said narrowband voice call SETUP message, destination information related to said call SETUP message;

c) maintaining destination information relating to active broadband calls handled by the ATM switch on SVCs;

d) comparing said destination information related to said call SETUP message to said destination information relating to said active broadband calls; and

e) mapping a call requested by said call SETUP message into an existing SVC when said destination information related to said call SETUP message substantially matches said destination information relating to a said active broadband call.

16. A method according to claim 15, wherein:

said narrowband voice call SETUP message comprises one of an SS7 ISUP call SETUP message, and an ISDN Q.931 call SETUP message, and said broadband voice call SETUP message is an ATM SETUP message.

17. A method according to claim 15, further comprising:

maintaining VC profile information regarding virtual channels on which said active broadband calls are mapped, and

comparing a VC profile related to said call SETUP message to VC profiles of said active broadband calls,

wherein said mapping only maps said call requested by said call SETUP message into an existing SVC when said VC profile related to said call SETUP message sufficiently matches a VC profile of the active broadband call.

18. A method according to claim 17, wherein:

said mapping includes determining whether said existing SVC has bandwidth available for said call requested by call SETUP message.

19. A method according to claim 15, further comprising:
receiving narrowband voice call data, and converting said narrowband voice call into an AAL2 type broadband call carried in said existing SVC according to said mapping step.

20. A method according to claim 15, further comprising:
generating a new SVC when said destination information related to said call SETUP message does not substantially match said destination information relating to said active broadband calls, wherein said mapping comprises mapping said call requested by said call SETUP message to said new SVC.

21. A method according to claim 17, further comprising:
generating a new SVC when said destination information and said VC profile related to said call SETUP message do not substantially match both said destination information and said VC profile relating to a said active broadband call, wherein said mapping comprises mapping said call requested by said call SETUP message to said new SVC.

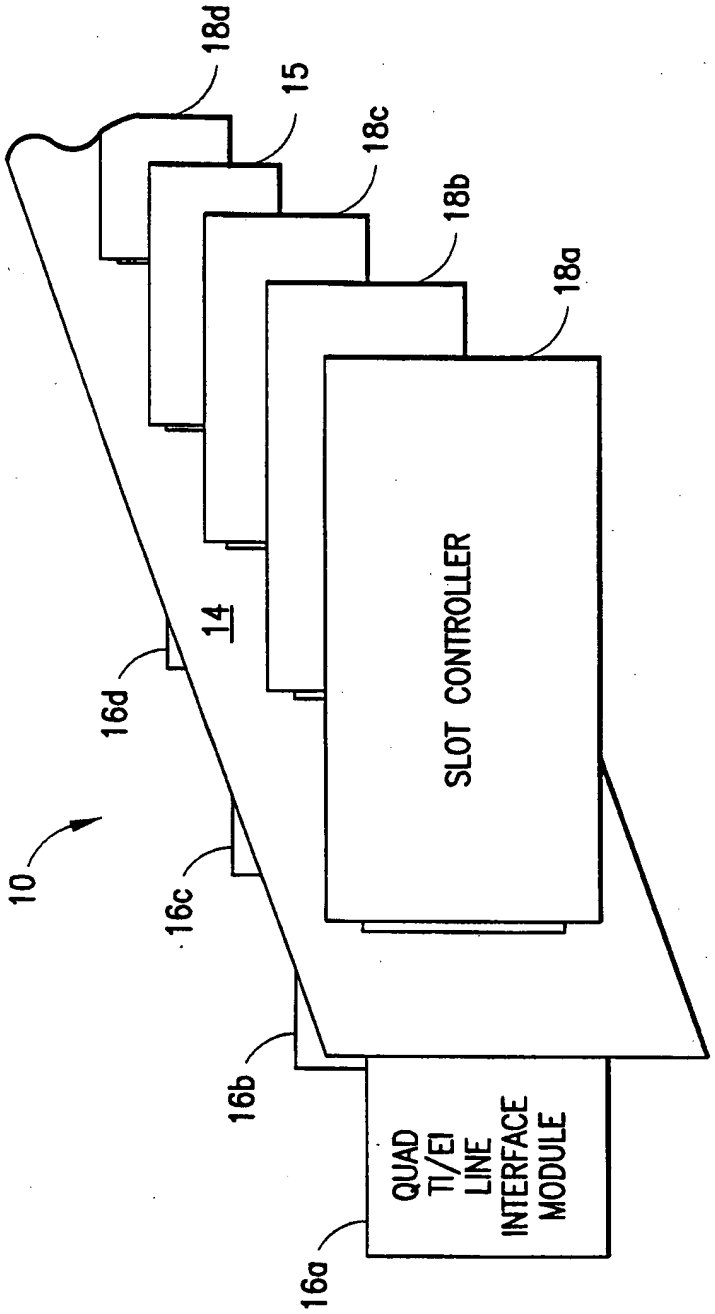
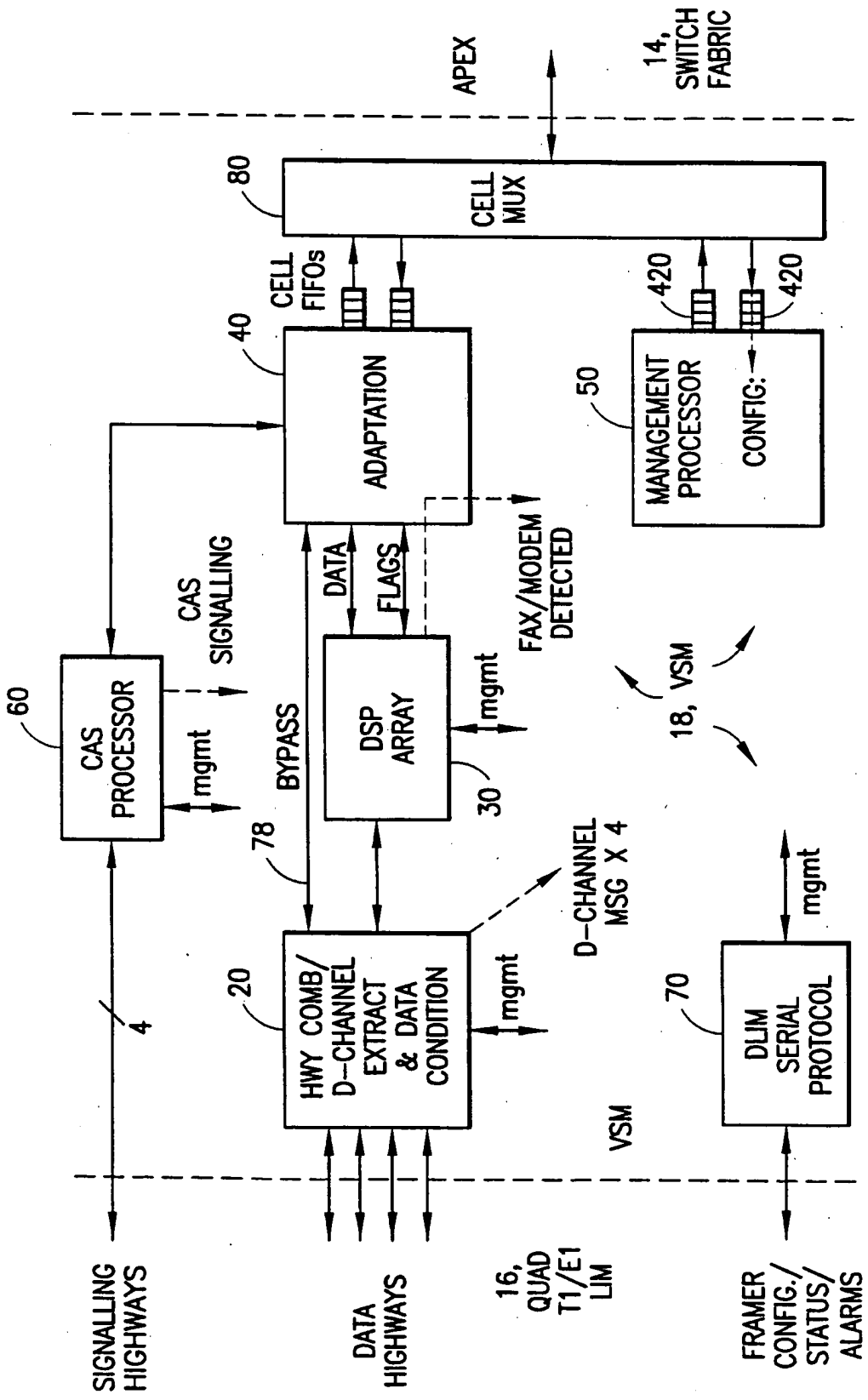

18d
15
18c
18b
18a
SLOT CONTROLLER
14
16d
10
16c
16b
QUAD T1/E1 LINE INTERFACE MODULE
16a

FIG.1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RESOURCE REQUEST PATHS

FIG.2

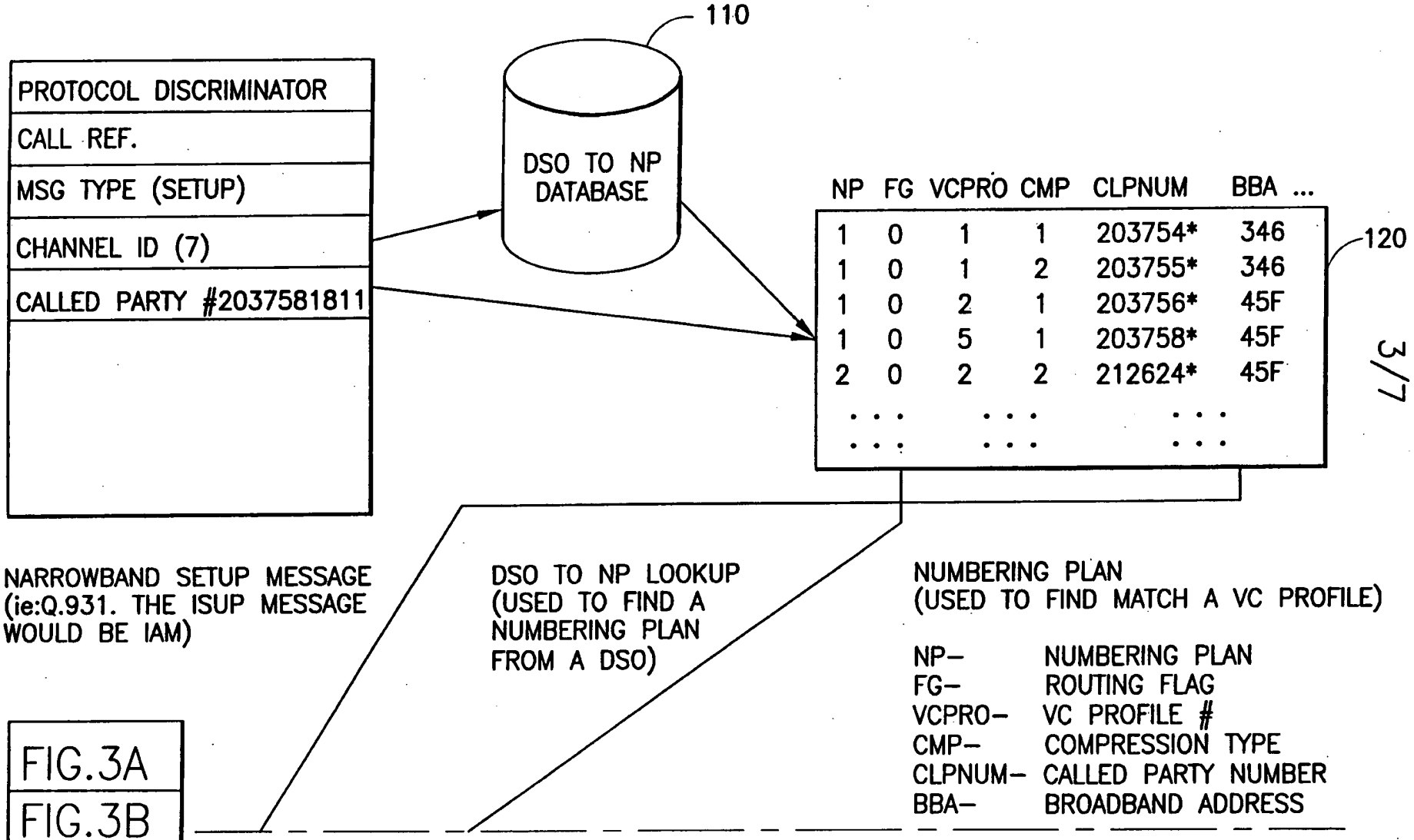

FIG.3A
FIG.3B

FIG.3

FIG.3A

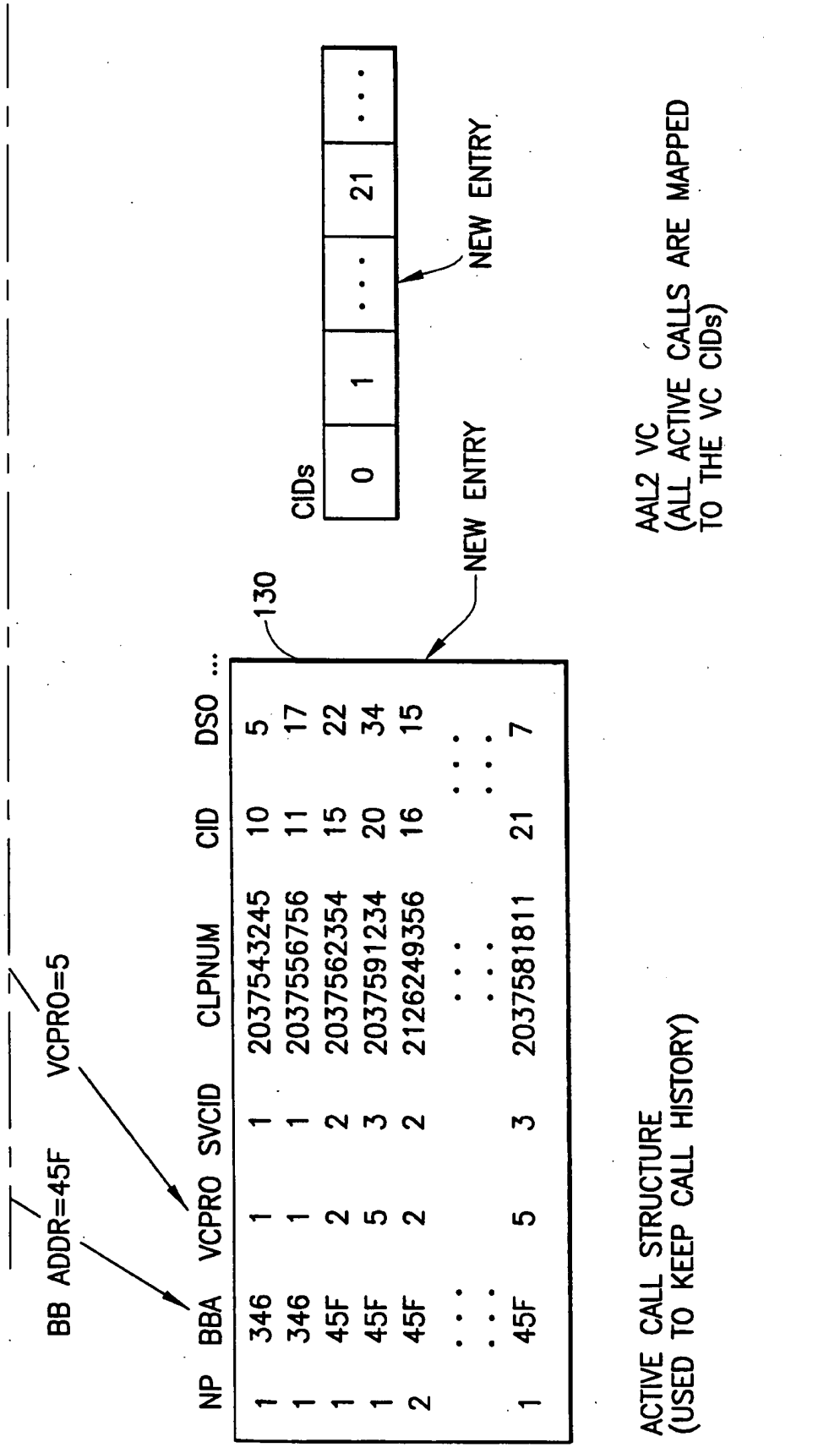
BB ADDR=45F
VCPRO=5
NP BBA VCPRO SVCID CLPNUM CID DSO ...
1 346 1 1 2037543245 10 5
1 346 1 1 2037556756 11 17
1 45F 2 2 2037562354 15 22
1 45F 5 3 2037591234 20 34
2 45F 2 2 2126249356 16 15
1 45F 5 3 2037581811 21 7
130
NEW ENTRY
CIDs
0 1 21
NEW ENTRY
ACTIVE CALL STRUCTURE
(USED TO KEEP CALL HISTORY)
AAL2 VC
(ALL ACTIVE CALLS ARE MAPPED
TO THE VC CIDs)

FIG.3B

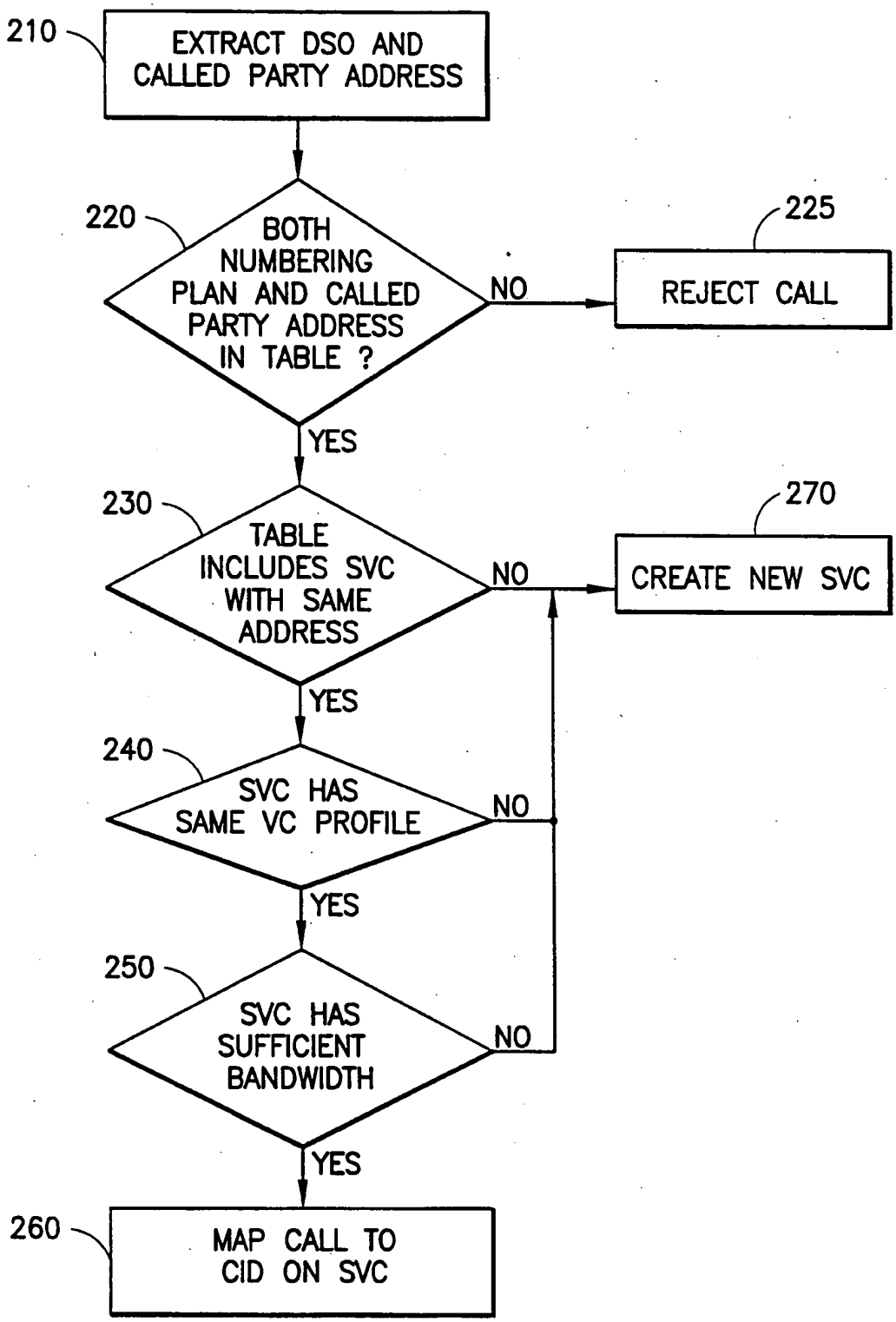
210
EXTRACT DSO AND CALLED PARTY ADDRESS
220
BOTH NUMBERING PLAN AND CALLED PARTY ADDRESS IN TABLE ?
NO
225
REJECT CALL
YES
230
TABLE INCLUDES SVC WITH SAME ADDRESS
NO
270
CREATE NEW SVC
YES
240
SVC HAS SAME VC PROFILE
NO
YES
250
SVC HAS SUFFICIENT BANDWIDTH
NO
YES
260
MAP CALL TO CID ON SVC

FIG.4

3.1.14 SETUP THIS MESSAGE IS SENT BY THE CALLING USER TO THE NETWORK AND BY THE NETWORK TO THE CALLED USER TO INITIATE CALL ESTABLISHMENT. SEE TABLE 3-15/Q.931.

TABLE 3-15/Q.931
SETUP MESSAGE CONTENT

INFORMATION ELEMENT	REFERENCE	DIRECTION	TYPE	LENGTH
PROTOCOL DISCRIMINATOR	4.2	BOTH	M	1
CALL REFERENCE	4.3	BOTH	M	2-*
MESSAGE TYPE	4.4	BOTH	M	1
SENDING COMPLETE	4.5	BOTH	0 (NOTE 1)	1
REPEAT INDICATOR	4.5	BOTH	0 (NOTE 2)	1
BEARER CAPABILITY	4.5	BOTH	M (NOTE 3)	4-12
CHANNEL INDICATION	4.5	BOTH	0 (NOTE 4)	2-*
PROGRESS INDICATOR	4.5	BOTH	0 (NOTE 5)	2-4
NETWORK SPECIFIC FACILITIES	4.5	BOTH	0 (NOTE 6)	2-*
DISPLAY	4.5	n→u	0 (NOTE 7)	NOTE 8
KEYPAD FACILITY	4.5	u→n	0 (NOTE 9)	2-34
SIGNAL	4.5	n→u	0 (NOTE 10)	2-3
CALLING PARTY NUMBER	4.5	BOTH	0 (NOTE 11)	2-*
CALLING PARTY SUBADDRESS	4.5	BOTH	0 (NOTE 12)	2-23
CALLED PARTY NUMBER	4.5	BOTH	0 (NOTE 13)	2-*
CALLED PARTY SUBADDRESS	4.5	BOTH	0 (NOTE 14)	2-23
TRANSIT NETWORK SELECTION	4.5	u→n	0 (NOTE 15)	2-*
REPEAT INDICATOR	4.5	BOTH	0 (NOTE 16)	1
LOW LAYER COMPATIBILITY	4.5	BOTH	0 (NOTE 17)	2-18
HIGH LAYER COMPATIBILITY	4.5	BOTH	0 (NOTE 18)	2-4

MESSAGE TYPE:SETUP
SIGNIFICANCE:GLOBAL
DIRECTION:BOTH

FIG.5a
PRIOR ART

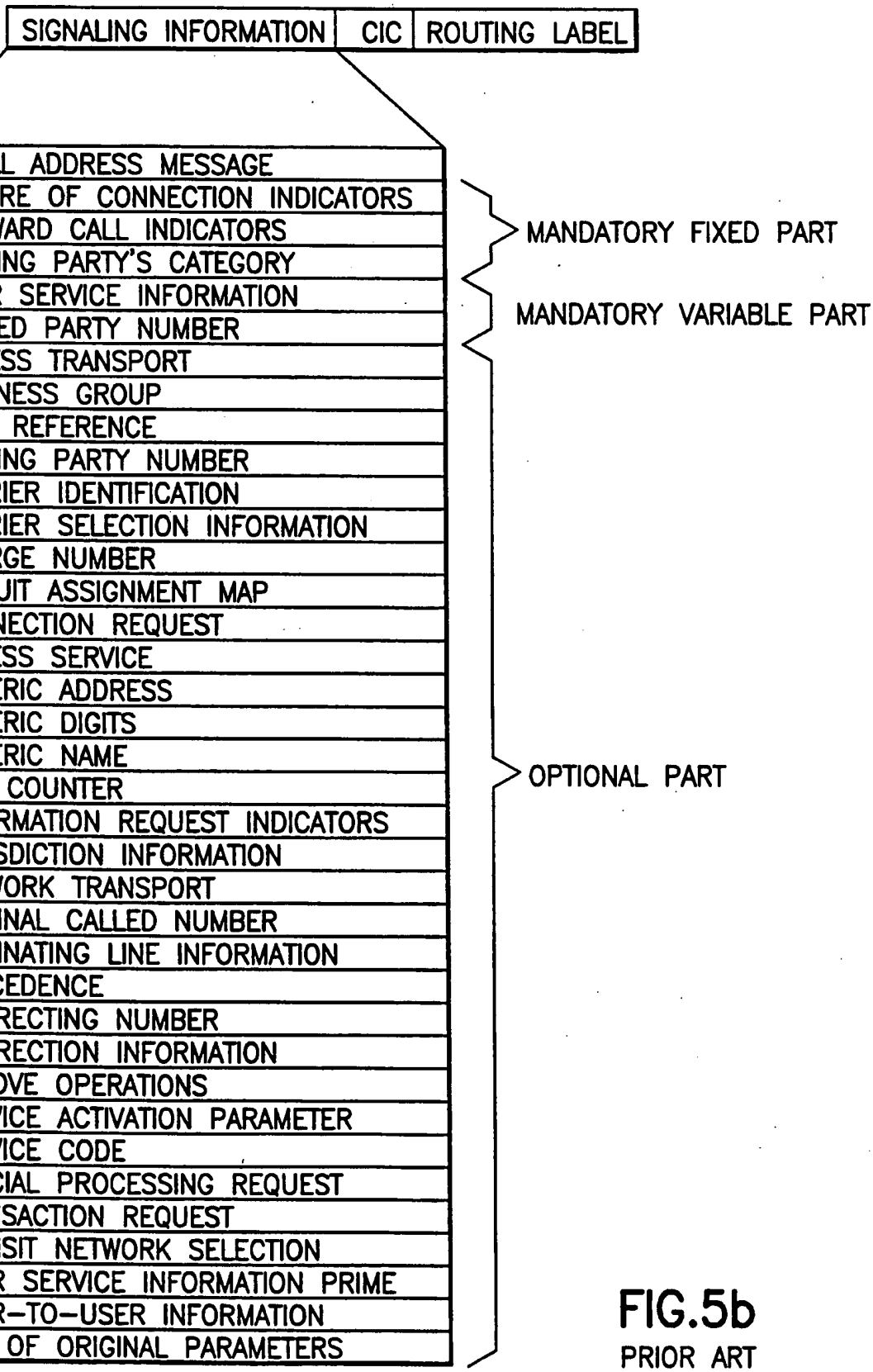

FIG.5b
PRIOR ART

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/08265

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :H04L 12/56

US CL :370/229, 230, 392, 395, 397, 399, 409, 466, 467, 522

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 370/229, 230, 392, 395, 397, 399, 409, 466, 467, 522

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	US 5,940,393 A (DUREE et al) 17 August 1999, See col 1, lines 49 to col 3, lines 25.	1-21

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search	Date of mailing of the international search report
01 JUNE 2000	07 JUL 2000

Name and mailing address of the ISA/US	Authorized officer
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